SCIENCE

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THE WIDDIFIELD AND BOWMAN ELECTRIC CAR-BRAKE.

AMONG the brakes tried at the Burlington brake tests in 1886, was that invented by Mr. W. P. Widdifield and A. T. Button of Uxbridge, Ontario, Can., who had a train of fifty cars equipped with their "independent momentum brake." At those tests it was demonstrated that this brake, in common with all of its competitors, developed very objectionable shocks at the rear end of long trains, owing to the fact that the brake-power could not be transmitted to the rear car quickly enough to prevent the concussion of the cars closing together. The inventors have now overcome this difficulty by the use of electricity, which gives simultaneous application or release of the brakes on the longest train.

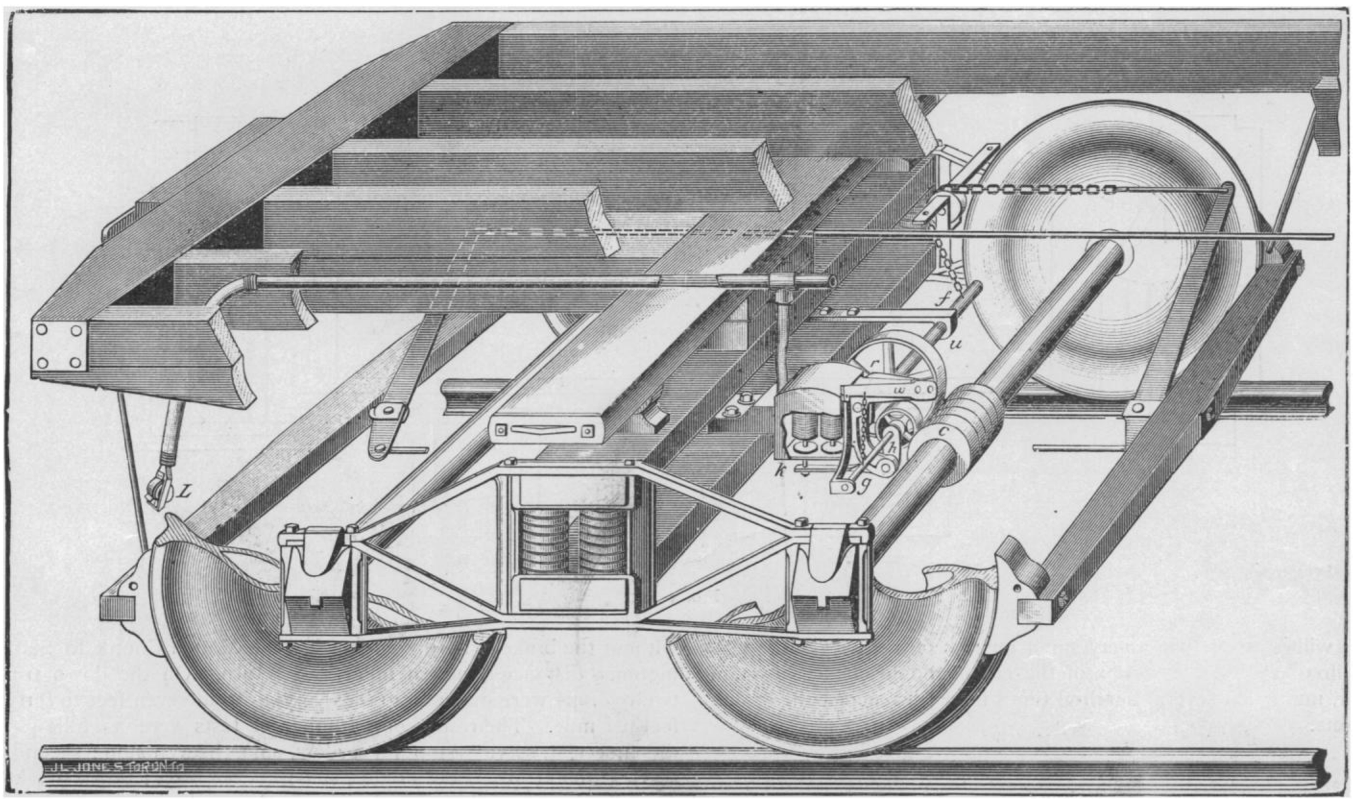

FIG. 1.—THE WIDDIFIELD AND BOWMAN ELECTRIC BRAKE.

Referring to the accompanying illustrations, Fig. 1 shows the application of the brake to the truck of the car, and Fig. 2 shows the details of the operating mechanism attached to the different cars; Fig. 3 shows the arrangement of the circuits, switches, and batteries; and Fig. 4, the coupling between the different cars.

A friction-pulley, *c*, about six inches in diameter, composed of fibre and soft metal, is cast on one of the car-axles. To apply the brakes, a momentary current of electricity is passed through conductors *B* and *C* (Fig. 3), causing electro-magnet *F* (Fig. 2), through its connection with spring-lever *h*, to bring the pulley *e* in working contact with the axle-pulley *C*. The pulley *e* immediately rotates, winding on its axle the chain *v*, which, through compound levers, *w* and *r*, brings the large friction-wheel *d* in frictional contact with the axle-pulley *c*, and causing it to rotate and wind upon its axle the power brake chain *s*.

Only a momentary impulse of electricity is required to apply the brake by turning the switches *Z′* or *Z″*, as the armatures of the brake-magnets are provided with a ratchet bar and pawl, *l* and *m*, which catch and hold the pulley in gear, and with a working pressure exactly in proportion to the electro-motive force of the current passed through the magnet *F*, and which can be regulated at the will of the operator. It remains in this condition until released by the operator by closing the circuit through conductors *B* and *D*, and magnet *p*, the armature-core of which, *n n*, is thus drawn upward, and trips the ratchet-pawl, and thus releases the brake.

The electrical energy is supplied by a storage-battery of about 10 cells, located on the locomotive; and it is estimated that a battery having a capacity of 100 ampére hours will, in ordinary freight-train service, require charging only about once in six months. In addition to the battery on the engine, an auxiliary battery is placed on the rear car, in order that, when circumstances require it, the brakes can be controlled from the rear of the train.[1]

[1] The brake and release magnets being in multiple arc, the power per car is the same, whether the train consist of one car or any number of cars.

Both brake and release circuits are normally open; but magnets Q and Q' are in closed circuits with one or two cells, and so located that if the circuit $T B$ should be broken by the train accidentally separating, the armatures P'' and P''' instantly fall, and automatically close the circuits on the conductors C and B, thus applying the brake to both sections of the train automatically.

The engine plant is light and portable, and can at any time be transferred from one locomotive to another by two men in a few minutes' time.

On May 21 a trial of this brake took place on the Lehigh Valley Railway. The train consisted of fourteen empty box-cars equipped with the brake, engine, tender, caboose, and one passenger-car

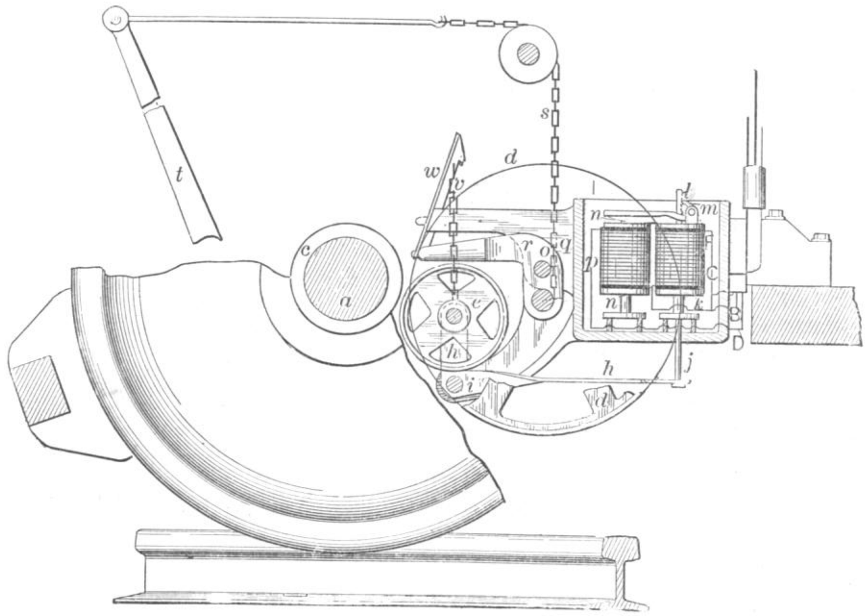

FIG. 2.

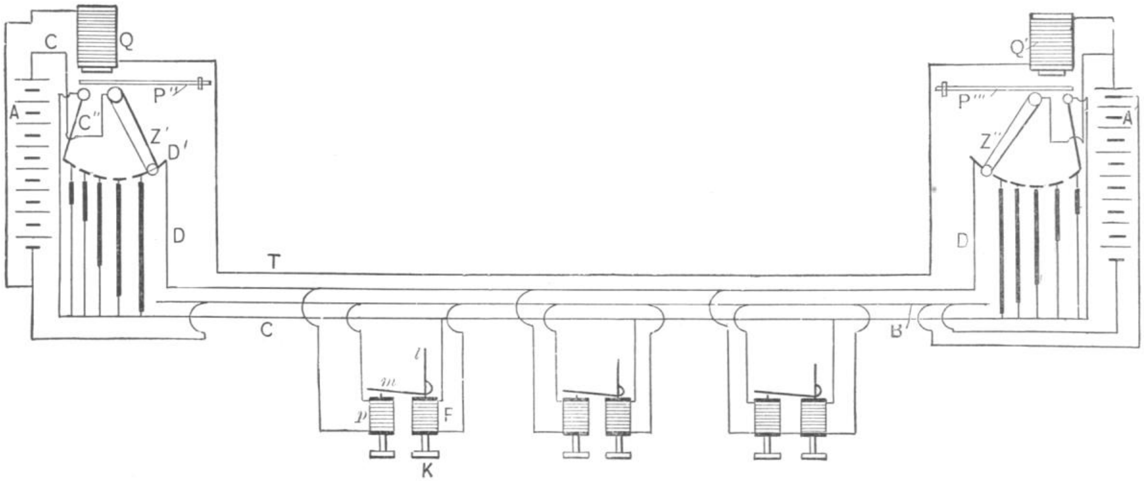

FIG. 3.

It will be seen that a very small amount of electrical energy is required, by the introduction of the compound levers and friction gear, multiplied several hundred times before it reaches the brake-beams.

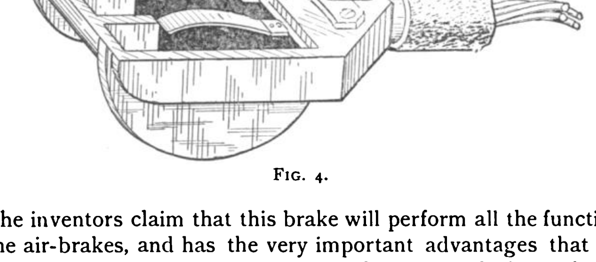

FIG. 4.

The inventors claim that this brake will perform all the functions of the air-brakes, and has the very important advantages that the train-men never lose control of it, as is the case with the air-brake, when a train is accidentally separated, and also that it will stop the longest train with no shock whatever.

without the brake. A run was made from Mauch Chunk to Slatington, a distance of eleven miles, and return. On the down trip twelve stops were made on grades varying from seven feet to forty feet per mile. The results of a number of tests were as follows: the first test, service stop for orders, smooth even stop; second, service stop at Mr. Lentz's office, smooth even stop; third, break-away, brakes applied automatically (speed, 25 miles), stopped in 17 seconds; fourth, brakes applied from the top of the car (speed 25 miles), stopped in 20 seconds; fifth, emergency stop (speed 35 miles), in 17 seconds; sixth, emergency stop, 6 cars in front only, braked (speed, 20 miles), in 25 seconds; seventh, long-service stop (speed, 30 miles), in 11 seconds; eighth, slow-up to 5 miles an hour, and go ahead; ninth, short-service stop (speed, 25 miles), in 38 seconds; tenth, emergency stop (speed, 30 miles), in 20 seconds; eleventh, fly cars into siding; twelfth, emergency stop (speed, 35 miles), in 22 seconds.

The eighth, "slow-up," was a good even partial stop, with quick release of brakes, when ordered to go ahead. The eleventh, "fly car on to siding," was particularly well done, and the control of the brake-power from the caboose was very favorably commented on. The return trip was made during a shower. Several emer-

gency and service stops were made to test the brakes on a slippery rail, all of which were made with great success. The extreme smoothness of the stops, absence of shocks to rear car, the perfect control of the brakes both from the engine and caboose, were noticeable features in this test.

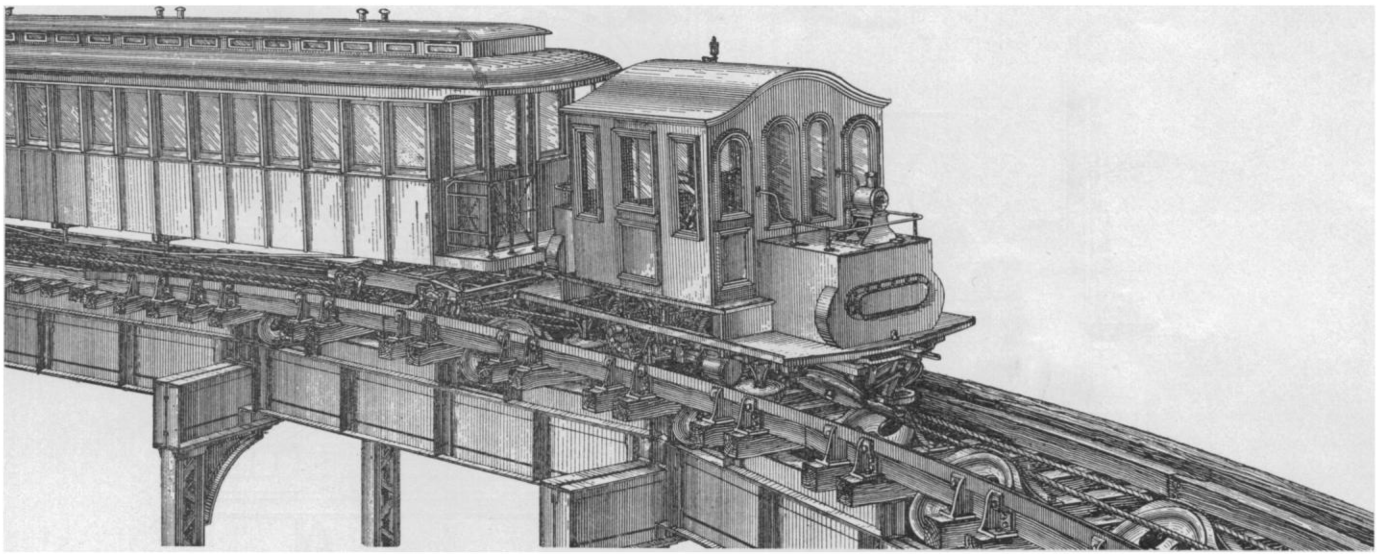

FIG. 1.—RAPID TRANSIT CABLE COMPANY'S GRIP MOTOR.

CABLE RAILWAYS.

CABLE railways have, where properly constructed, given great satisfaction, and the system has steadily grown in favor since its introduction on Clay Street, San Francisco, Cal., in 1873. The best example of a line of this character for heavy service is to be found on the New York and Brooklyn Bridge, over which passengers were first taken Sept. 24, 1883, from which time to May 1, 1888, 91,376,778 passengers were carried; and the delays to traffic due to the cable system amounted in the aggregate to but 20 hours and 46 minutes, — an average per month of only 23½ minutes, or less than one minute per day. This is on a road about 1⅛ miles long, having 3¾-per-cent grades, operating trains at from 4-minute to 1½-minute intervals (since reduced to 1¼ minutes), with a speed of 10 miles per hour. It may be doubted if any road in this or any other country can show a better record. The grips there used consist of two pairs of packed wheels or rollers, set in frames opposite each other. Between these is a pair of solid gripping-jaws. The cable is first brought into contact with the rollers, after which the jaws come into action, and serve as a lock. This grip has these great disadvantages, however: inability to take hold of the cable except at certain fixed points, or to operate on curved tracks; and too small contact of the rollers with the cable; and, to exert the requisite gripping-power on the cable, it must be applied with great force, especially at the time of starting the train, when the greatest power is required. This "pinch" on the cable

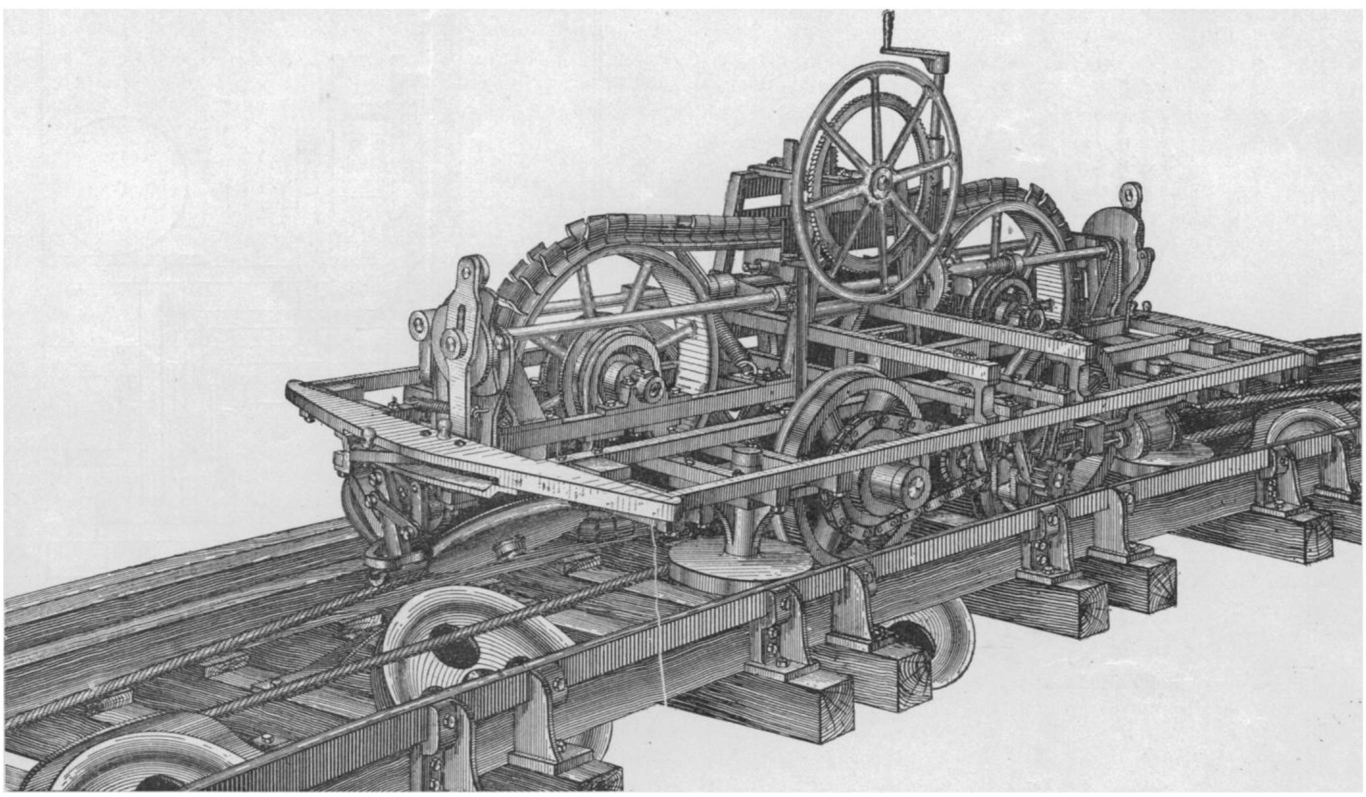

FIG. 2.—MOTOR WITH CAB REMOVED.